REMARKS

The Office Action dated November 17, 2003 has been received and carefully noted. The above amendments to the claims, and the following remarks, are submitted as a full and complete response thereto. No new matter has been entered. Claims 23-38 and 40-49 are pending in the instant application and have been examined.

Claims 23-38 and 40-49 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter of the invention. Applicants have addressed the alleged points of indefiniteness and respectfully submit that the claims are now definite under 35 U.S.C. § 112, second paragraph. Reconsideration and withdrawal of the above rejection are respectfully requested.

Claims 23-25, 28-31, 33, 37-38, 40, 42-45, and 47-48 were rejected under 35 U.S.C. § 102(b) as being anticipated by *Carney et al.* (U.S. Patent No. 5,937,011). Claims 23-27, 29-38 and 40-49 have been rejected under 35 U.S.C. § 102(e) as being anticipated by *Helms* (U.S. Patent Pub. 2001/0014592). The above rejections are respectfully traversed according to the remarks that follow.

The present invention is directed, according to claim 23, to a multi frequency carrier transmitter. The transmitter includes input means for receiving a plurality of different digital signals to be transmitted, the different digital signals to be transmitted on different carrier frequencies, digital modulators for modulating the different digital signal at the respective frequencies, digital to analog converter means for converting a

composite digital signal comprising the different digital signals at the respective carrier frequencies to analog form, thereby generating a composite analog signal, amplifier means for receiving and amplifying the composite analog signal and predistortion means for predistorting the plurality of different digital signals during or after modulation of the different digital signals by the digital modulators and prior to amplification of the composite analog signal by the amplifier means. The predistortion provided by the predistortion means is subsequently altered in dependence on a difference between the input different digital signals and the output at the amplifier means.

The present invention is directed, according to claim 44, to a multi carrier frequency transmission method. The steps of the method include receiving a plurality of different digital signals to be transmitted, the different signals to be transmitted on different carrier frequencies, modulating the different digital signals at the respective frequencies, combining the plurality of different digital signals to provide a composite digital signal comprising the different digital signals at the respective carrier frequencies, converting the composite digital signal to analog form, thereby generating a composite analog signal and amplifying the composite analog signal. The method further includes predistorting the plurality of different digital signals prior to amplification of the composite analog signal by the amplification means during or after the modulation step and altering the predistortion applied to subsequent digital signals in dependence on the difference between the different digital signals and the amplified signal.

The present invention is directed, according to claim 45, to a multi frequency carrier transmitter. The transmitter includes input means for receiving a plurality of different digital signals to be transmitted, the different digital signals to be transmitted on different carrier frequencies, digital modulators for modulating the different digital signals at the respective frequencies and combining means for receiving the different digital signals modulated at the respective frequencies to generate a composite digital signal. The transmitter also includes digital to analog converter means for converting the composite digital signal to analog form, generating a composite analog signal, amplifier means for receiving the composite analog signal and amplifying the composite analog signal and predistortion means for predistorting the plurality of digital signals during or after modulation of the different digital signals by the digital modulators and prior to combination of the different digital signals by the combining means, the predistortion provided by the predistortion means being subsequently altered in dependence on a difference between the input different digital signals and an output at the amplifier means.

The present invention is directed, according to claim 46, to a multi frequency carrier transmitter. The transmitter includes input means for receiving a plurality of different digital signals to be transmitted, the different digital signals to be transmitted on different carrier frequencies, digital modulators for modulating the different digital signals at the respective frequencies, digital to analog converter means for converting a composite digital signal comprising the different digital signals at the respective carrier

frequencies to analog form, generating a composite analog signal and amplifier means for receiving and amplifying the composite analog signal. The transmitter also includes predistortion means for predistorting the plurality of digital signals during or after modulation of the different digital signals by the digital modulators and prior to amplification of the composite digital signal by the amplifier means, the predistortion provided by a the predistortion means being subsequently altered in dependence on a difference between the input different digital signals and a plurality of different digital sample signals. The transmitter also includes analog to digital conversion means for converting a sample of the output of the amplifier means into digital form to generate a composite digital sample signal and chanelizing means for converting the composite digital sample signal into the plurality of different digital sample signals.

The present invention is directed, according to claim 47, to a multi frequency carrier transmitter. The transmitter includes an input for receiving a plurality of different digital signals to be transmitted, the different digital signals to be transmitted on different carrier frequencies, a plurality of digital modulators for modulating the different digital signal at the respective frequencies, a digital to analog converter for converting a composite digital signal comprising the different digital signals at the respective carrier frequencies to analog form, generating a composite analog signal, an amplifier for receiving and amplifying the composite analog signal and a predistorter for predistorting the plurality of different digital signals during or after modulation of the different digital signals by the digital modulators and prior to amplification of the composite digital signal

by the amplifier, the predistortion provided by the predistorter being subsequently altered in dependence on a difference between the input different digital signals and the output at the amplifier.

The present invention is directed, according to claim 48, to a multi frequency carrier transmitter. The transmitter includes an input for receiving a plurality of different digital signals to be transmitted, the different digital signals to be transmitted on different carrier frequencies, a plurality of digital modulators for modulating the different digital signals at the respective frequencies, a combiner for receiving the different digital signals modulated at the respective frequencies to generate a composite digital signal and a digital to analog converter for converting the composite digital signal to analog form, generating a composite analog signal. The transmitter includes an amplifier for receiving the composite analog signal and amplifying the composite analog signal and a predistorter for predistorting the plurality of different digital signals during or after modulation of the different signals by the digital modulators and prior to combination of the different digital signals by the combiner, the predistortion provided by the predistorter being subsequently altered in dependence on a difference between the input different digital signals and an output at the amplifier.

The present invention is directed, according to claim 49, to a multi frequency carrier transmitter. The transmitter includes an input for receiving a plurality of different digital signals to be transmitted, the different digital signals to be transmitted on different carrier frequencies, a plurality of digital modulators for modulating the different digital

signals at the respective frequencies, a digital to analog converter for converting a composite digital signal comprising the different digital signals at the respective carrier frequencies to analog form, generating a composite analog signal, an amplifier for receiving and amplifying the composite analog signal, a predistorter for predistorting the plurality of different digital signals during or after modulation of the different digital signals by the digital modulators and prior to amplification of the composite digital signal by the amplifier, the predistortion provided by a the predistorter being subsequently altered in dependence on a difference between the input different digital signals and a plurality of different digital sample signals, an analog to digital converter for converting a sample of the output of the amplifier into digital form to generate a composite digital sample signal and a chanelizer for converting the composite digital sample signal into the plurality of different digital sample signals.

Generally, the present invention provides a transmitter which predistorts individual digital signals which have been or are being modulated in the digital domain. The fact that the distortion is performed on the different digital signals requires that the predistortion is performed prior to combination of the different digital signals to generate a composite digital signal which may then be converted to a composite analog signal by a digital to analog converter, which in turn may then be amplified.

Conducting the predistortion on the plurality of different digital signals during or after modulation provides a different transmit path for each channel of the multi-frequency transmitter. Further, this system allows for precise predistortion of each

channel during or after modulation so as to provide improved linearity. Improved linearity is beneficial in order to prevent the leakage of power into adjacent channels; this is undesirable in that a reduction in system capacity and/or a reduction in signal quality results.

With respect to the cited prior art, *Carney et al.* and *Helms*, Applicants respectfully assert that the present invention, as claimed in independent claims 23 and 44-49, is neither taught nor suggested by the cited prior art. Claim 23 recites, in part, "predistorting said plurality of different digital signals during or after modulation of said different digital signals by said digital modulators and prior to amplification of the composite analog signal by said amplifier means," with independent claims 44-49 reciting similar subject matter. This aspect of the invention is neither taught nor suggested by the cited prior art, as discussed below.

On page 4 of the last Office Action, the Office alleges that *Carney et al.* discloses "predistortion step/means (14) for predistorting said plurality of different digital signals wherein the predistortion performed by step/means (14) is performed after the modulator step/means and prior to the amplifier step/means". Applicants respectfully assert that *Carney et al.* fails to disclose what has been alleged.

Column 3, lines 56 to 58, of *Carney et al.* clearly states that "the predistorter operates by taking as inputs the composite baseband signal (125) generated by the digital combiner (122), the digitalised HPA output signal (150), and produces data for the look-up table (140) and a calibration input signal (148)". It should be readily apparent that the

predistorter (14) operates on the composite baseband digital signal (125), which may also be called the "composite digital signal". This is clearly different from the present invention wherein the predistortion means is provided for "predistorting said plurality of different digital signals", i.e. predistortion prior to combination.

For completeness, it should also be noted that the predistorter (14) of *Carney et al.* receives as an input the digitised HPA output signal (150), where this signal is required in order to provide feedback in the transmitting system. This aspect is aptly supported by the presence of the "HPA sample buffer" (146). In summary, *Carney et al.* does not disclose predistorting said plurality of different digital signals as disclosed in the present invention because the predistortion of *Carney et al.* is performed upon a composite digital signal.

Referring to the rejection relying on *Helms*, the Office asserts that *Helms* discloses that the modulating step/means is "inherently included" so as to provide a plurality of different carrier modulated signals (in1, ..., inn) at the input of the predistortion unit. The Office Action cites page 2, paragraph 28, of *Helms* for support of this statement, but this paragraph indicates only that the input signals in1, in2, ..., inn are "carrier-related" and further that they are "digitised". Paragraph 28 goes on to state that the carrier-related input signals are therein allocated to the carriers 1 to n according to Figure 2. Allocation does not mean that the carriers are combined with the information signal at this point. The signal is still at baseband and is thus unmodulated. This paragraph does not indicate that the input signals are already modulated and, therefore, there can be no inference that

a modulating step/means is "inherently included" prior to the input of the input signals to the predistortion unit of the apparatus disclosed by *Helms*.

Paragraph 31, which begins at the end of page 2 of *Helms*, does indicate where the modulation is performed. As previously explained, the digital upward conversion units (DUC) perform a shift to a digital intermediate frequency (IF); this step may be said to be digital modulation of the signals innpr to the intermediate frequency (IF). The digital signals at intermediate frequency are subsequently added and converted to analog form by the summation unit (SUM) and the digital to analog converter (DAC), respectively. The composite analog signal at intermediate frequency is subsequently modulated in the upward mixer UM which converts the signal to the transmitting frequency (paragraph 31, lines 6 to 9).

The Office also asserts that *Helms* discloses predistorting said plurality of different carrier modulated signals wherein the predistortion is performed by step/means (PDD) after the modulator step/means. As described above, the predistortion described by *Helms* is not performed during or after modulation of the input signals as is described by the present invention. The arguments presented in the Office Action allege that the modulating step/means is inherently included prior to the input of the carrier-related input signals to the predistortion unit, but this is not the case. In fact, *Helms* does not disclose predistortion during or after modulation, as claimed in the present invention.

Additionally, Applicants respectfully assert that the modulating means/step cannot be "inherently included" in *Helms*. It is not sufficient that given the present application a

person skilled in the art *may* see how to adapt the disclosure of *Helms* in order to arrive at the present application but rather such disclosure must be present although not explicitly disclosed. "To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.' " *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999) (citations omitted).

In summary, *Helms* does not teach or suggest the predistortion of the plurality of different digital signals during or after modulation of the different digital signals by digital modulators. In fact, *Helms* discloses predistorting (PDn) a plurality of different digital signals (inn) prior to modulation of said different digital signals by digital modulators (DUC).

Consequently, neither *Carney et al.* nor *Helms* teaches or suggests the present invention for at least the reasons given above. As such, Applicants respectfully assert that the rejections of claims 23 and 44-49 are improper for failing to teach or suggest all of the elements of those claims. Similarly, claims 24-38 and 40-43 should be allowed over the prior art of record for at least the dependence of those claims on claim 23. Thus, Applicants respectfully assert that the application is in condition for allowance and that the application should be allowed to proceed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the applicants undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, the applicants respectfully petition for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,

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